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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Daniel Sabatino Group Art Unit: 3746
Serial No.: 10/760,663 Examiner: Kim Tae Jum
Filed: January 20, 2004
Title: THERMAL MANAGEMENT SYSTEM FOR AN AIRCRAFT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION UNDER RULE 1.131

I, David L. Wisz, state as follows:

1) I am a patent attorney Registration No. 46,350, at all times representing Applicant UNITED TECHNOLOGIES CORPORATION, of Hartford, Connecticut 06101, U.S.A in the above-referenced application, and responsible for its preparation and filing.

2) I have reviewed the disclosure documents and correspondence with the client concerning the above-referenced application in preparing this Declaration.

3) The invention disclosure was prepared by the inventors on a date before the effective 35 U.S.C. 102(e) date of 2004/0194627 to *Huang* which claims a filing date of September 8, 2003. Exhibit A attached to this Declaration is a copy of an invention disclosure document that was completed prior to September 8, 2003. The signature page of the invention disclosure document has been signed by two of the inventors Daniel Sabatino and Louis J. Spadaccini adjacent the figures. Two persons have also witnessed the signature and understood the inventive concept at that time. Dates on the signature pages and the dates on the drawings included in the disclosure form have been redacted, but I have looked at these dates and all of the dates are prior to September 8, 2003.

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3) I was informed of the decision made to prepare and file a patent application by UNITED TECHNOLOGIES CORPORATION. Diligence was maintained throughout the preparation and filing of the application. The subject application was filed on January 20, 2004. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Dated: March 3, 2006


DAVID L. WISZ

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Integrated FSU and Aircraft Thermal Management System with an optimal-ester based oil

Inventors: Louis J. Spadaccini, Daniel R. Sabatino

BACKGROUND

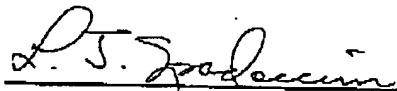
Aircraft Thermal Management Systems (TMS) provide temperature control of flight critical components by employing the fuel flow to the combustor as a heat sink. However, the heat capacity of aviation fuel is limited by a coking temperature limit, above which coke deposits form, resulting in a progressive degradation of engine performance. To avoid this coking condition, the thermal management system often employs supplemental heat exchangers that reject heat to either ambient or engine fan bypass air flow. This method removes heat from the engine cycle and thus reduces engine efficiency as well as introduces additional weight in the form of air/liquid heat exchangers.

INVENTION

The Fuel Stabilization Unit (FSU), allows the fuel to remain stable at much higher temperatures without coking by deoxygenating the fuel, enabling higher temperature loads to reject their heat to the fuel. Although the exploitable heat sink (maximum operating temperature) can be increased by the FSU, the cooled components must also be able to survive at higher temperatures. In this embodiment this is accomplished by coupling the FSU with a high-temperature lubrication oil (e.g. optimal-ester based oil). This allows components to reject heat exclusively to the fuel and survive. This embodiment eliminates the additional weight and performance penalty of air/liquid heat exchangers as well as improves engine performance by capturing waste heat in the engine cycle.

Figure 1 shows a traditional TMS schematic for a geared turbofan that rejects heat from various heat loads, including main bearing and fan drive gear system, to the fuel. In this case, the heat to be rejected is greater than the capacity of the fuel and therefore requires additional cooling via heat exchangers that reject heat to the engine fan by-pass duct..

Figure 2 shows a schematic for an example TMS design that includes an FSU to allow the fuel to exceed the traditional coking temperatures. Potentially, no additional air heat exchangers are required and all of the heat generated by the system components can be rejected to the fuel. In order to utilize the high temperature fuel heat sink, the heat loads must also be a sufficiently high temperature to provide adequate heat transfer to the fuel (and survive at those temperatures). Therefore, the new system includes high temperature oil that allows the engine oil-loop (shown in Figure 2) to exceed current oil temperature limits and achieve a temperature high enough to efficiently reject heat to the fuel. The location of the FSU in the diagram represents only one of many possible locations. For example the FSU could be located between the generator and fan gear heat exchangers or downstream of the main fuel pump centrifugal stage.



Inventor's signature

Date [REDACTED]

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Date [REDACTED]

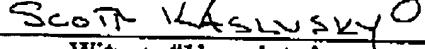
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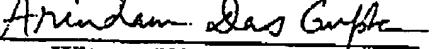


Witness #1's signature

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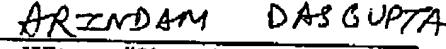


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Witness #2's signature

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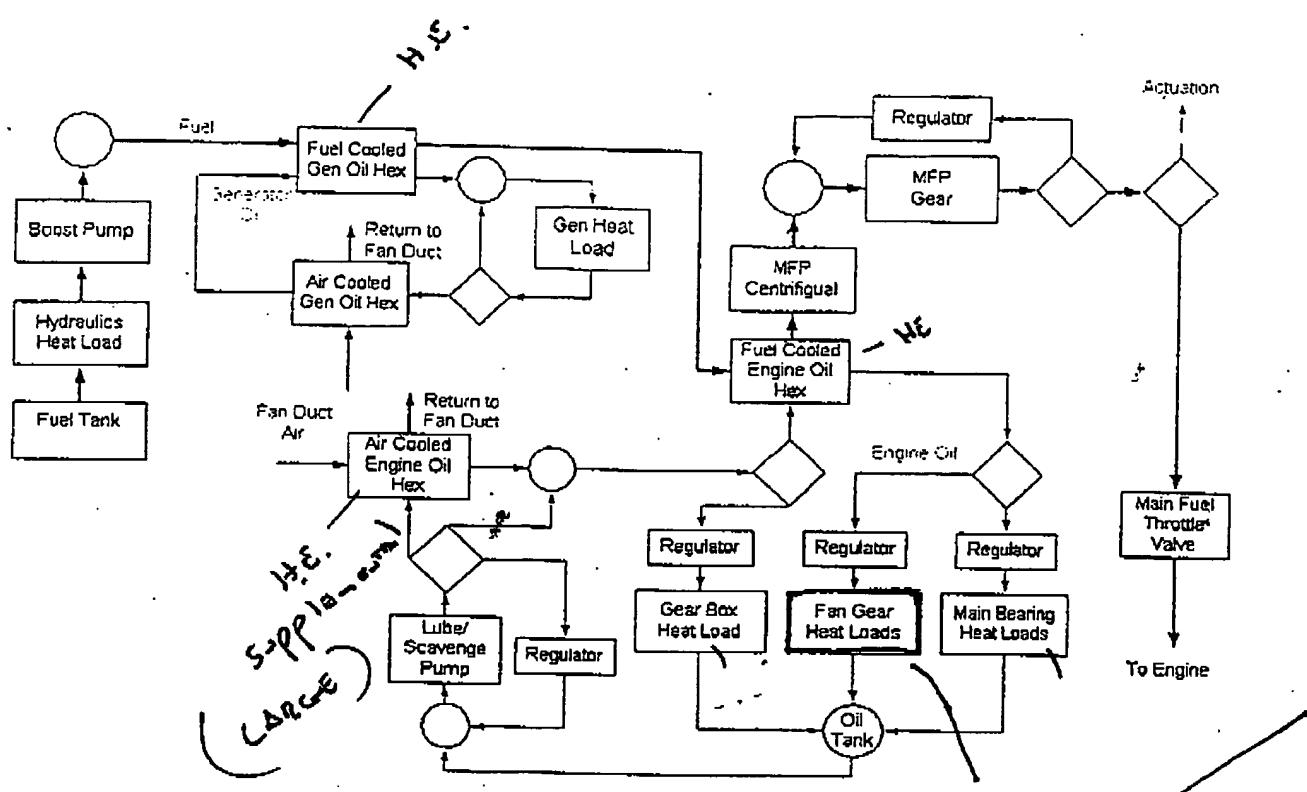


Figure 1: Conventional thermal management system for geared turbofan engine

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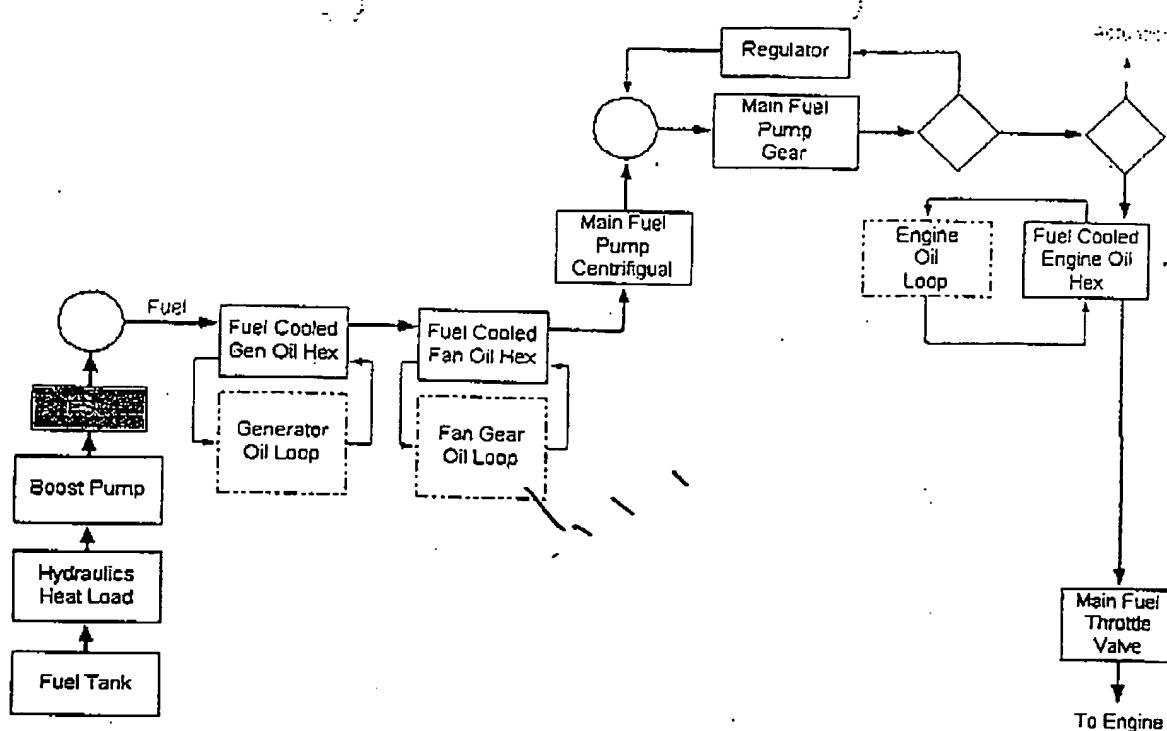


Figure 2: Example Thermal management system for a geared turbofan engine employing an FSU.

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